Demystifying Mental Health Information Needs Through Integrated Definition (IDEF) Activity and Data Modeling

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Today, the process of mental health assessments and treatment are difficult to describe and assimilate into other medical areas. Integrated patient summaries and treatment descriptions are poorly standardized. Any aggregate data analysis must rely on the very few standardized patient data points that may include some demographic information, diagnosis and codable procedures. This paper describes one of the first published attempts to use business process reengineering (BPR) Integrated Computer Assisted Manufacturing Definition (IDEF) activity and data modeling within a focused clinical setting. The clinician's desire to focus on patient care has been used to create both a current and an idealized activity and data model. Clinical patient information was used to build an analyzable database. This provides the potential to track a patient in data throughout a continuum of care. Conceptually, outcomes management is able to use clinical, rather than administrative or claims, data. These models were used to create a prototype for a computer-based patient record which would allow outcomes management. It was tested successfully as a proof of concept.

INTRODUCTION

The normal collection of patient information follows a format which will include a chief complaint, history of present illness, past medical history, review of systems, physical exam, laboratory tests, diagnostic procedures, progress notes and periodic summaries. Different providers will add information in discrete notes and sometimes in totally separate records. Some controversy occurs in medical records in the area of functional area charting versus integrated charting. Functional area charting acknowledges the cohesive nature of different health care disciplines as each attempt to chart a patient's progress. However, the reality is that patient information is scattered throughout many individual records, usually in narrative form. The only consistent variables which can be used to analyze outcomes are primarily demographic (age, gender, marital status, insurance carrier). In addition, procedure and diagnostic codes required for reimbursement are also collected. Should questions about outcomes and evaluations occur, it is necessary to create new records and databases. This adds to the quantity of information and the non-patient workload of the practitioner. From all the patient information collected, it is often difficult to obtain a clear picture of who a patient is. Demographics, diagnosis, and procedures do not capture the complete essence of a patient's physical, psychological, and social strengths or problems. Ideally, treatment is tailored based upon patient strengths and problems, yet this is the portion of the medical record which is left relatively unstructured.

To resolve the problems discussed above, the Center for Addiction Medicine was created at the Uniformed Services University of the Health Sciences in October 1992. The Center was tasked to use Integrated Computer Assisted Manufacturing Definitions (IDEF) methodology to better define the current and ideal business practices of Army Drug and Alcohol treatment clinics. IDEF modeling began within the aircraft industry in the early 1980s. By carefully defining mutually exclusive activities and their relationships, each activity could be decomposed into sub-activities. Activities were related in terms of their inputs, outputs, controls and mechanisms.[1]

This paper will briefly define the current clinical information management problem and the results of using IDEF modeling to bring better definition to critical patient care activities by defining an activity model, and patient data needs by defining a conceptual logical data model. Data which are collected to provide treatment also serves to define the patient in data. If done logically, a relational database comprehensively and compactly describing the patient is created. The logic helps minimize required data and provides an infrastructure in which to store data that develop from new technologies. Providers put information into a well designed database to help efficiently manage a patient treatment plan. Outcome evaluations become a byproduct.

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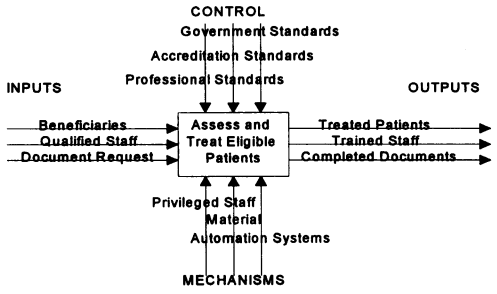
METHODS

Seven Army drug and alcohol outpatient treatment clinics were intensively studied and a current IDEF activity model was developed. Based upon improvement opportunities, an idealized straw man activity model was developed for discussion by all clinical directors attending an Army conference in 1993.

Prior to that conference, a current data model was developed which highlighted the dependency on a form based system which had a large number of administrative reports, required because there was no ability to use the chart directly. Following the Clinical Directors' conference, an idealized data model was developed which would support the desired activities. To develop that model, screen designs and screen flows were created to meet the needs of clinicians. Once approved by a consortium of clinicians working in different clinical settings and at different levels of supervisory responsibility, the logical model was converted into a physical data model for conversion into a proof of concept test. It was tested within a clinical setting.[2,3]

RESULTS

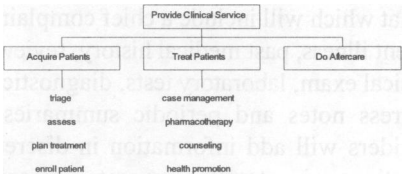
Business Process Reengineering and IDEF Models



TOP LEVEL IDEF MODEL FOR CLINICAL CARE

Figure One highlights the top level of the ideal model. The entire beneficiary population is eligible for care according to need and the ability to provide service. One of the key outputs is a treated patient. To be hired, staff must be qualified, however, to have a quality care system, staff must be supervised, trained and kept current. Only staff with appropriate privileges can assess and treat patients. Facilities, supplies and other material must be present to provide the service. Services must meet standards of care established by the professional community, accreditation bodies and government regulation. This high level IDEF diagram illustrates the notation used throughout the model as it is decomposed. For simplicity, the following two figures put the activities into an organizational diagram to highlight those areas drug and alcohol counselors thought were critical for patient care.

Figure Two breaks down the mission to assess and treat eligible patients into three key areas, providing a clinical service, providing a consultation/liaison service, and providing support services. Each of these three mutually exclusive activity areas can be broken down further as illustrated. Conceptually, through careful definition, each activity should not overlap, nor should there be redundant activities. Note that there is no division between inpatient and outpatient services. To have created that distinction would have created a duplication of activities throughout the entire model. Everyone in health care should be doing clinical, consulting and support services. The only difference between inpatient and outpatient care are the expense of specialized resources and time spent doing specific activities.



To illustrate, **Figure Three** highlights critical clinical activities. Patient acquisition includes triage, comprehensive biopsychosocial assessments, treatment planning, and enrolling the patient to accept the treatment plan. At that point, treatment begins and can be grouped into four key areas. Case management is the management of any problem for which the provider cannot directly treat but needs to follow.

Pharmacotherapy relates to medical treatment. A surgeon may wish to include procedures as another activity. Counseling includes all psychotherapeutic and simple counseling techniques. Health promotion addresses those who do not have clinical diagnosis but would benefit from a psycho-educational experience. Aftercare is a frequently overlooked activity which takes time but is not easily reimbursed. This is the follow-up of discharged patients to evaluate the status of the treated patient and provide appropriate outreach interventions. To complete the picture, the support activities include total quality management (TQM), training, supervision, and administration. All these require time and are considered valuable activities. The overall clinical goal was to streamline the data collection, reporting and TQM activities while allowing appropriate time for supervision and training.

Current data collection problem:
Document Everything

The critical interactions take place between a provider, the patient, and collateral sources of information. Although one provider is illustrated, any one of a number of providers may be involved depending on expertise and requirements perceived to be necessary to provide care. A provider is perceived as the objective expert who will gather the specific signs of illness or injury which lead to a diagnosis and a recommended treatment. The patient is perceived as the critical focus of attention. A subjective history is gathered from the patient and specific symptoms of illness or injury will be obtained. The general focus is on the biomedical or physiological dimension, although psychological and social factors may play a critical role. A well defined history from the patient will permit the objective exam to be brief and well focused. Collateral sources of information may be both subjective and objective. Additional subjective information can be obtained from family members, friends and employers. The history and objective physical exam are enhanced by laboratory studies, psychological tests, or diagnostic procedures. These collateral sources help fill in gaps in the patient history, may confirm an initial diagnostic impression, or lead the provider to investigate new problems.

Form focused documentation

Today, the provider is responsible for documenting and storing each item of information. Appropriate forms are filled out, usually by the provider but sometimes by the patient. The discrete forms are assembled into a patient record. Except for procedure codes and diagnosis, impressions about patient problems and strengths are written in narrative prose. To complicate the situation, several records on a single patient may exist throughout the health care system.

When documenting quality care, patient records must be reviewed. However, forms within records generally lack continuity and a program evaluator has to read each record fully, carrying patient information from one form to the next before reaching conclusions on the adequacy of patient care through the documented record. Significant trends concerning patient care successes and failures can easily elude both provider and external program evaluator. The patient record(s) are virtually valueless when attempting to evaluate program outcomes. Outcome studies become a research issue. Upon this foundation, many automation initiatives begin.

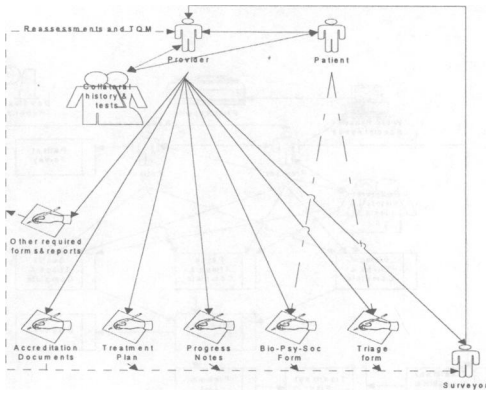


Figure Four highlights the problem. The desired interaction is between provider, patient and collateral sources (which can include other people and laboratory procedures). The provider is primarily responsible for entering all data into discrete parts of the record. This may take considerable time. The patient may enter some data, but it may be poorly integrated into the general record. As soon as the patient sees another provider or goes to another facility, another patient record is generated, with many of the same components. A surveyor reviewing records can only look from one to the next to assess whether there is a trend. Randomly selected records may not capture important problems. It is also possible that critical patient care problems are lost within the pages of any one of many possible patient records.

Developing a logical database

The validated idealized activity model served as the foundation for a logical data model which was developed to serve as the template for an Automated Clinical Information System (ACIS). The activity model was clearly patient centered, but also had provider and administrative foci. Clearly, the most important first developmental component centered around the patient. The ACIS prototype was developed using the latest *Oracle* products and a proof of concept was tested in September 1995.

Critical modules for a complete patient data system

Nine problem oriented patient-centered modules are required to fully describe the patient and relevant activities. They are: Registration, Triage, Complete biopsychosocial evaluation, Integrated summary, Diagnostic assessment, Problem list, Treatment plan, Treatment progress, and Patient satisfaction.

Patient focused documentation

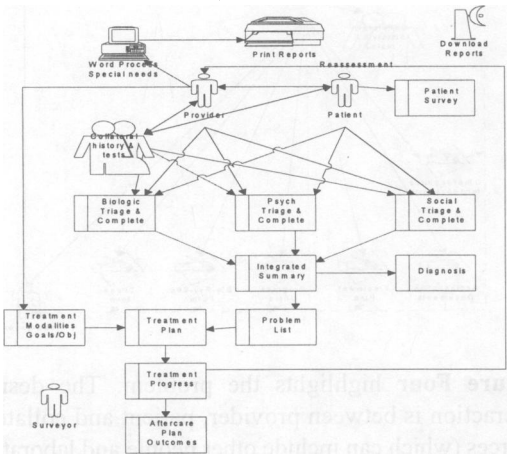


Figure Five highlights a patient focused model that can be used for outcomes management. The change from the initial data model is quickly apparent. Any provider, collateral source and patient can place appropriate attributed data into a biopsychosocial database that includes both triage and comprehensive assessment elements. In addition, the patient can add survey data that reflects knowledge and satisfaction with the health care received. The key to the model is the requirement to carefully integrate the information, an area usually poorly structured in current medical records. That integration results in three products; diagnosis (of interest for reimbursement and research), strengths (not listed but important for determining the correct level of care), and problem list (which is the real need to provide treatment). These modules are highly patient focused. The provider then matches specific treatments to problems, establishing a plan. The capability to provide treatment comes from a data source focused on the provider. Once a plan is established, treatment progress is tracked. The first integrated summary may be perceived as the first history and physical. Discharge summaries and other reports simply revisit the initial information gathered. The surveyor, patient and supervisor can easily access data according to need while also protecting patient confidentiality. The critical component of the model can be coherently represented in a comprehensive database that highlights biological, psychological and social status. All beneficiaries can access the right level of care, at the right time and at the right place. As a beneficiary accesses the system, relevant information becomes available to the health care provider involved in that person's care.

This model permits data element integration. Most data collected upon assessment (and re-assessment). Essential data are tied to triage, problem definition, discharge goals, treatment plan , goals and objectives, or outcomes. This logical relationship allows the amount of data collected to be lessened over the current system. The collected data have the clear purpose to define the patient in relationship to the patient's need for health care intervention.

DISCUSSION

The new automation process, incorporating the activity and data modeler

With an understanding of data needs, based upon a comprehensive activity and logical data model, the health care provider can make highly structured demands for automation which will facilitate the business of patient care. Value added activities are automated.

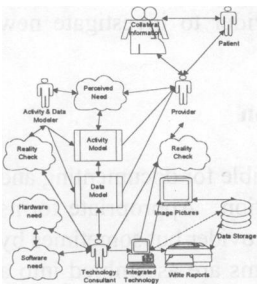


Figure Six highlights the relationship that can exist between technology consultants and clinicians if the architecture of a health care system has been carefully developed with an activity and data model. Beyond the triangular relationship between patient, provider,

and collateral sources, a second triangular relationship develops between the provider, IDEF activity and data modeler, and technology consultant. Perceived needs are captured by the IDEF modeler to develop the logic for a technology consultant to use for automation development. Strict requirements for customized automation are identified, developed, tested, checked for reality, implemented, and subjected to ongoing evaluation for updates.

CONCLUSION

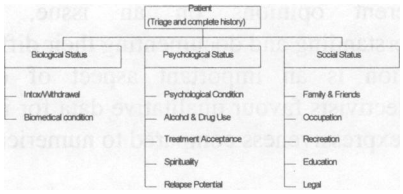


Figure Seven highlights the essence of a patient represented in data using an automation system designed using IDEF modeling. New technologies developed for the purpose of patient care can be fit into one of the data tables which are part of the biopsychosocial description of a patient. The chaotic array of forms which were used to define a patient in the traditional patient record has been replaced by a logical system in which the patient has become a primary focus of attention. Expert systems and artificial intelligence can be used to enhance the quality of care given to any patient. Reports can be generated to highlight triage needs or determine whether assessments are of a consistently high quality. Surveyors can monitor outcomes online and in real time. Best standards of practice can be developed based upon the capability of the health care system and responses of patients to specific treatments. Training needs can be driven by clinical data and research findings. Bench research can be more quickly integrated into clinical care as applied research becomes imbedded as new treatment protocols, available to accept volunteers when appropriate.

In almost any health care system, knowledge about the patient's biological, psychological, and social status is critical if treatment is to be individualized to patient needs. Information obtained from various technologies developed for patient care can be fit into the appropriate logical data table. The importance each data element has towards patient recovery can be monitored over time and over many patients. Outcome evaluations become a byproduct of a well designed, patient-centered, clinical information system. The electronic filing cabinet of narratives created according to perceived need has been replaced by a highly structured, analyzable, database. Based upon this logic, data gathering can become more efficient over time, with higher quality care being given. At the same time, costs are lowered as non-patient administrative time is kept to a minimum.

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Disclaimer

The views expressed within this paper are strictly those of the author and do not represent the opinions or official views of the Army, Department of Defense, or any other government organization or agency.

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